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Transducer Replacement Procedure

Procedure

History

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Rev. 03 / C	**April 2008**	NB	FL	FL	20207	released	New Logo, V6 considerations

Important

All information and technical specifications in this documentation have been carefully checked and compiled by the author. However, we cannot completely exclude the possibility of errors. **Smith Meter GmbH** is always grateful to be informed of any errors.

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1. INTRODUCTION

This manual describes mounting and dismounting of the transducers for the MPU ultrasonic gas flow meter delivered by FMC Smith Meter, previously FMC Kongsberg Metering. If further information is needed, please do not hesitate to contact our service department.

We reserve the right to make changes to the construction and/or configuration at any time, this manual is based on the latest information, and may be subject to changes.

1.1. Contact Address if Assistance is Required

	Publisher	Customer Support
Contact Address:	FMC Measurement Solutions Ellerbek Operation Regentstrasse 1 25470 Ellerbek Germany	FMC Technologies (Service Department) Regentstrasse 1 25474 Ellerbek Germany
Telephone No.:	(49) 4101 304 - 0	(49) 4101 304 (-0)- 105
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Internet:	www.fmctechnologies.com	

Table 1 Contact Adress

1.2. Copyright

All technical information contained in this manual, including any drawings and technical specifications, shall remain the property of FMC Technologies and may not be used (other than for the operation of this product), copied, multiplied, passed on or communicated to a third party without prior written permission of FMC Technologies.
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1.3. Trademarks

Products listed are trademarks of their respective manufacturers. Company names listed are trade names of their respective companies.

1.4. Equipment Required

1. Jaw wrench 40mm
2. Combination wrench 22mm
3. Combination wrench 19mm
4. Fit-up aid
5. Transducer Assembly tool (Ratchet with nut)
6. Torque key
7. Hexagon socket wrench 8mm
8. Hexagon socket wrench 6mm
9. Screwdriver

Picture 1 Equipment

1.5. Consumables

- O-rings (ID=15, D=1, NBR 70)
- Back-up rings (ID=17, OD=21,5, b=1,4, POM)
- Copper Grease (Copaslip or equivalent)
- Silicone grease (Gleitmo 750 or equivalent)
- Loctite 577 or equivalent

1.6. Reference Documents

	Document No.	Title
1	USM-0000020565	MPU User Manual, Series B
2	DOK-501	MPU Transducer Replacement Procedure using Retraction Tool

Table 2 Reference Documents

1.7. Warnings

Warning: Always make absolutely sure that there is no pressure in the pipe, before removing the Transducer cover.

Do not use metal tools or similar that can damage the inner thread of the Transducer when dismounting the Transducers. The Transducer has a M20x1,5 thread to make it possible to use the Transducer Retraction Tool.

Caution: Special attention is required to avoid damages to flame paths, see Picture 2**.**

If flame paths are damaged, parts must be replaced and cannot be repaired.

Picture 2 Flame Paths

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2. DISMOUNTING PROCEDURE

This procedure describes how to remove and mount a Transducer with **NO PRESSURE** in the pipeline. This can only be done before the spool piece is installed in the pipeline, or if the operational pressure is atmospheric and the pipeline is drained of any lethal or flammable gases.

If it is necessary to remove a transducer from the MPU without shutting down the line, this is possible by using the Transducer Retraction Tool. This tool may be ordered as an option, and will be delivered with its own operational manual. Alternatively, this can be done by the supplier's service engineer, bringing the suppliers own Transducer Retraction Tool.

If the transducer is replaced by a new one, don't forget to update the acoustic path length and the zero calibration data in the database. See USM-0000020565 "User Manual, MPU Series B" [1] for details.

Unless otherwise stated, nuts and screws are removed by turning counter-clockwise, and tightened by turning clockwise.

Make sure the workplace is suitable for this operation, protected from rain- or sea water, dirt or oil spill. cover the MPU with a protection hood if necessary.

2.1. General information on explosion protection

The transducer is an explosion-protected, electrical appliance, safety-tested and certified.

***** No intervention, either mechanical or electrical, is permitted *****

R I S K O F E X P L O S I O N

Repair of the transducer is not possible. In the event of a defect the entire transducer must be replaced.

Installation and repair work must only be carried out by authorised dealerships or skilled technical personnel having due regard to the assembly and installation instructions.

Electrical installation must take place in accordance with VDE 0165 (EN 70079-10).

All cables used must comply with the chemical and climatic requirements of the installation site. All cables must be laid (protected) in such a way that they cannot be damaged. Wire end sleeves must be used when connecting the wires. The mounting instructions of the cabling manufacturer must be observed.

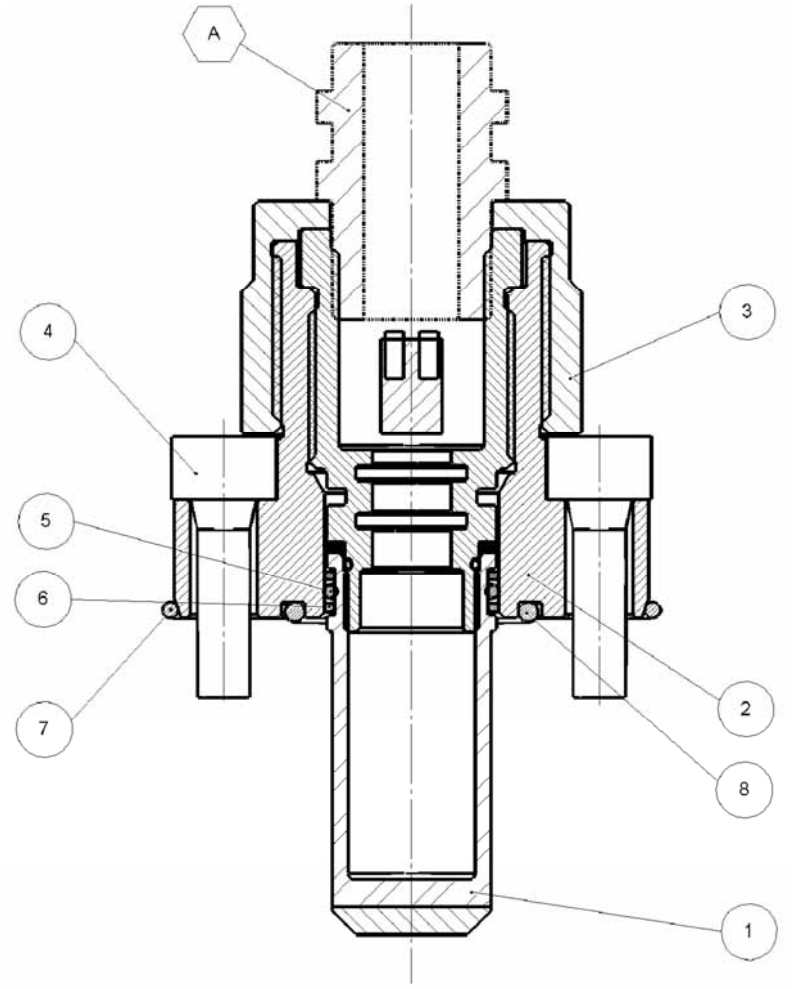
When wiring the US transducer, precautions must be taken which prevent electrostatic discharge from causing damage to the US transducer.

The manufacturer's EC Declaration of Conformity is only valid if the system is installed according to the specifications of the manufacturer.

2.2. Ex-relevant Data

Type of protection:		II 2 G EEx d IIB T4 / T5 CE 0102
EC type test certificate number.		PTB 07 ATEX 1018
Type US -B-…	T_{amb} for T4:	-55°C - +100 °C
Type US -A-…	T_{amb} for T5:	-40°C - +80°C

3. DISMOUNTING THE TRANSDUCER



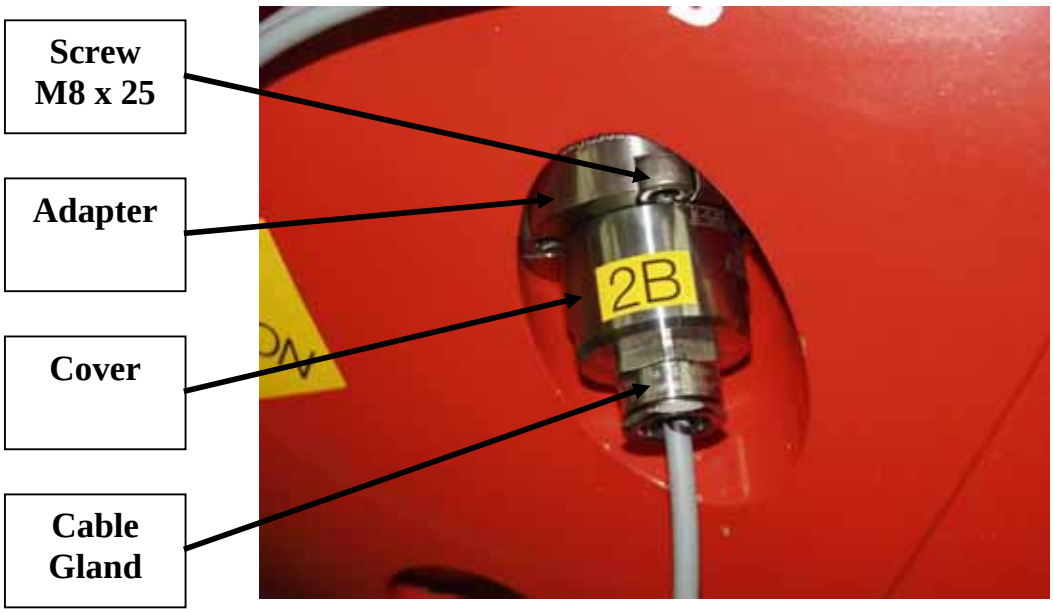
Picture 3 Transducer Assembly

ITEM NO.	PART NUMBER	DESCRIPTION	MATERIAL	QTY.
1	870007040	Transducer Assembly (CL600) - calibrated		1
2	870007018	Adapter	1.4404, EN 10222-5, APZ EN 10204 3.1	1
3	870007010	Cover, REV B	1.4404, EN 10222-5, APZ EN 10204 3.1	1
4	200004260	M8 x 25 Head Cap Screw	DIN 912, M8 x 25, A4-80, APZ EN 10204 3.1	4
5	200010961	O-Ring 18,77 x 1,78	NBR 70	1
6	200012096	Backup Ring 19,4 x 22 x 1,2	BV, PTFE, Z52	2
7	200007501	O-Ring 69 x 2	NBR 70	1
8	6000006	O-Ring 27 x 2,5	NBR 70	1

3.1. Dismounting, Short Form

1. De-energise the electronic system and observe any possible explosion-relevant information on the type plate
2. Make sure that the pipe is de-pressurised
3. Loosen the locking nut of the cable gland and pull off toward the back
4. Completely loosen the M20 x 1.5 cable gland and pull off to the back.
5. Completely loosen the cover (3) and pull off to the back. Cable gland and cover remain on the pipe.
6. using a screwdriver, open the locking mechanism of the connection terminal by applying pressure on the white unlocking button, and pull out the cable (see Fig. 3)
7. Loosen the transducer (1) by unfasten with the Transducer Assembly Tool. The transducer can be completely removed manually.

Attention: Do not loosen the Allen screws (4)! If the cylindric screws are loosened, tighten again diagonally with 24 Nm.

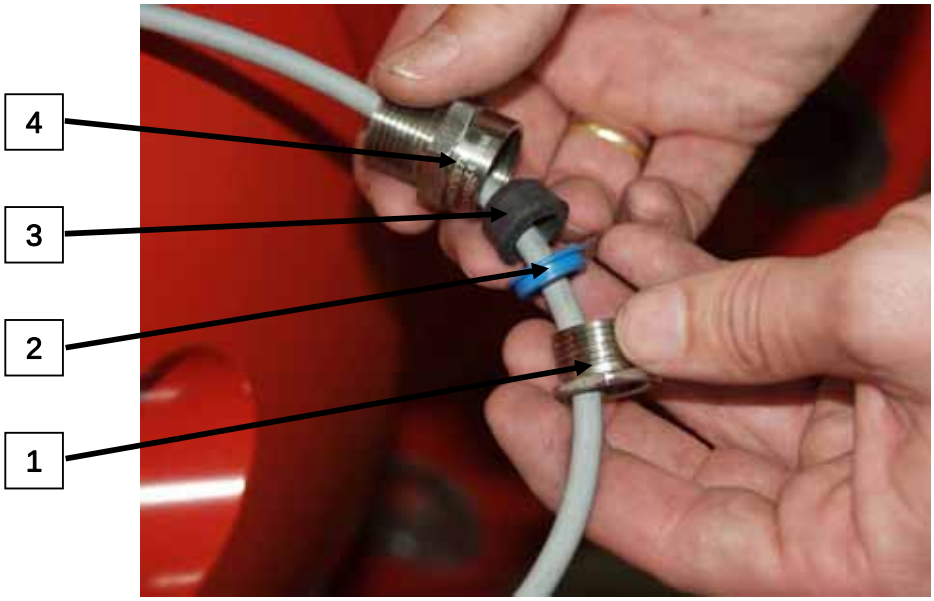


Picture 4 Transducer mounting parts

3.2. Dismounting, detailed form

It is necessary to dismount the cable gland from the cover before removing the transducer.

Picture 5 Cable gland and cover



Picture 6 Cable gland parts

Remove the clamping screw (1), the blue plastic washer (2), the sealing rubber (3) and the body of the cable gland (4)

Picture 7 Cable junction

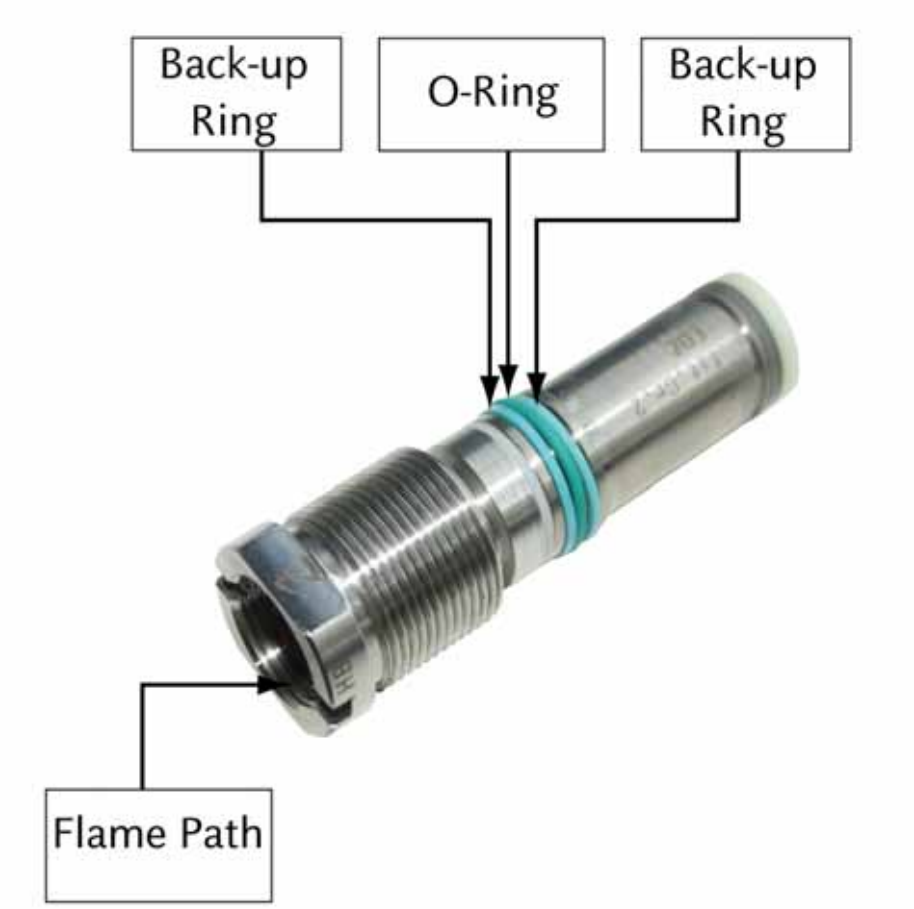
Unfasten the wires by pressing with a screw driver on the white release button.

Picture 8 Detailed picture how to release the wire

Picture 9 Disassemble transducer

Disassemble the transducer with transducer assembly tool (15Nm)

CAUTION: If any damage is discovered to the Transducer, this Transducer adapter must be clearly marked such that the Transducer Retraction Tool is NOT used on this specific Transducer. This must also be reported to the one responsible for the MPU.



Picture 10 Transducer with O-rings and Back-up rings mounted

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4. MOUNTING PROCEDURE

4.1. Preparing Procedure

Before starting the mounting procedure, the following procedure must be performed:

4.1.1. Cleaning

Pollutions must be removed using suitable tools and liquids, preferably isopropanol.

4.1.2. Visual Inspection

- Inspect the inside of the adapter and transducer for damages, grease or pollution from the process.
- Transducers with O-ring and Back-up rings.
- Tolerances for cover mounting.

4.1.3. Assumptions

It is assumed that the Transducers are zero calibrated.

4.1.4. Prepare Transducer/ Adapter

4.2. Preparing Transducer

A. Remove the old O-ring and Back-up rings.

B. Make sure that the mating faces are clean and dry. When cleaning a joint face, use a tool which is not likely to score or damage the face, and remove any burrs or nicks with an oilstone or fine file.

CAUTION: Make sure that the flame paths (see Picture 4) do not have any damage. If so, the part must be replaced.

C. Replace the O-ring and the Back-up rings on the Transducer (see **Picture 3**). Put silicon grease (Gleitmo 750 or equivalent) on the new O-ring. Do not use too much silicon grease on these O-ring; wipe off superfluous grease before mounting. The silicon grease can make an acoustic contact between the Transducer and the Spool Piece, which will disturb the ultrasonic signals.

D. Make sure that the Transducer is clean and undamaged.

Note: If the same transducer is re-installed, the O-rings and backup rings must be replaced in any case. Only use original spare parts.

4.3. Mounting, Short Form

CAUTION: Make sure the Transducers are mounted in correct position according to the calibration certificate.

A. Replace o-ring and back-up rings. Use silicon grease on O-ring and copper grease (e.g. Copaslip) on the screws.

B. Check the adapter internals, clean it before mounting..

CAUTION: Make sure that the flamepaths (see Picture 2) do not have any damage. If so, the part must be replaced.

C. Carefully insert the Transducer into the adapter.

D. Mount the Cable Gland (EU)

E. Connect the Transducer Cable Connector.

F. Mount the cover.

G. Update the database if transducers are replaced.

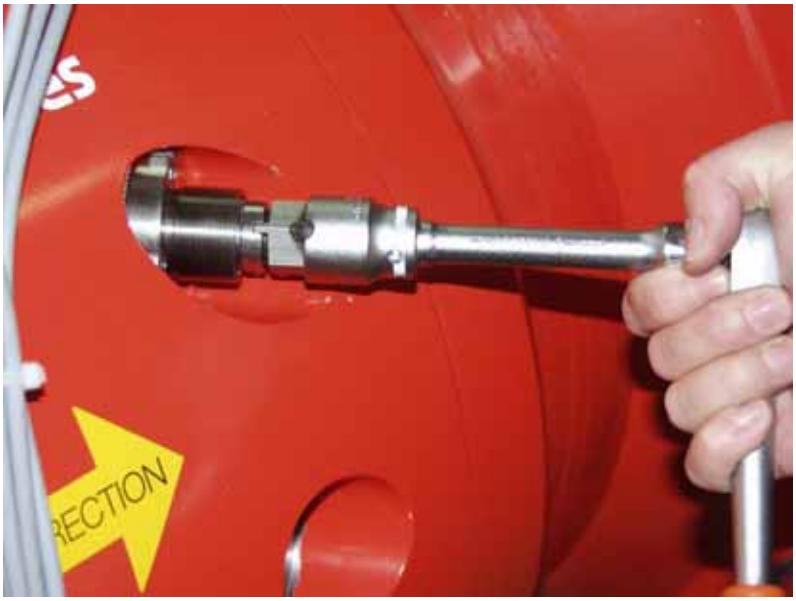
CAUTION: The screws must be of required quality, the threads must be lubricated and correct torque must be used (ref section 3.1).

4.4. Mounting the Transducer

Make sure the Transducers are mounted in correct position according to the calibration certificate.

Picture 11 Mounting the transducer

Make sure that the transducer and the thread is clean and screw it manually into the adapter



Picture 12 Assembly tool

Use the transducer assembly tool and a torque wrench with 15 Nm to tighten the transducer. Mounting the cover with cable gland

Picture 13 Cable gland

Mount at first the cable gland and then the cover

Picture 14 Wires

Connect the wires to the cage clamp junctions. Use ferrules for the wires. Push the wires into the junction; if necessary use a screw driver for support. You don't need to open the junction for mounting. Pull the wire slightly to check that connection.

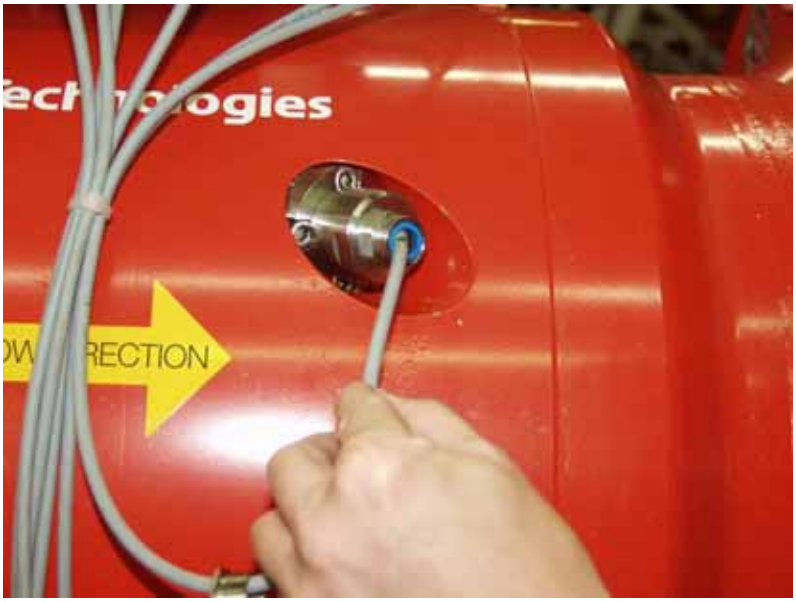
Picture 15Transducer with mounted wire

Picture 16 Fasten the cover hand-tight

Picture 17 Mount the cable gland

Dismount the cable gland completely and mount the bottom part of the cable gland

Picture 18 Insert the rubber seal



Picture 19 insert the blue plastic washer

Picture 20 Dismount the cable gland

Mount the clamping screw hand tight. Check that the rubber seal clamps the cable sheath completely. To check pull soft the cable, it must be impossible to pull the cable out of the cable gland. Affix the transducer sticker

4.5. Mounting the adapter

To replace the adapter is only necessary if it is damaged!

Picture 21 Clean the transducer mounting surface

Picture 22 Use the fit-up-aid for positioning

Picture 23 Use the hexagon socket wrench for the srews

Picture 24 Use torque key , torque is 24 Nm

PARAMETER CONFIGURATION

5.1. General

It is necessary to update the database if transducers have been replaced. During first time assembly database configuration will be a part of the process, and this chapter will be irrelevant.

Updating the database requires knowledge of how to maneuver in the MPU 1200 database, and shall be performed by trained personnel.

Spare transducers are delivered in pairs, with a calibration certificate for each temperature and pressure combination with corresponding signal frequency, and measurement certificate of the length of each transducer. The spare transducer pair is calibrated in an arbitrary position. They can be mounted in any position, but it is important that the transducers are kept within the same pairs.

A “Calibration Node” is defined as a combination of pressure and temperature.

Definition of transducer pairs:

Position Group A	Position Group B
1A	1B
2A	2B
3A	3B
4A	4B
5A	5B
6A	6B

Table 3 Transducer pair definition

5.2. Calibration certificate

The relevant data in the calibration certificate is stated in the header and the 4 first rows of the table (see Figure 1 below).

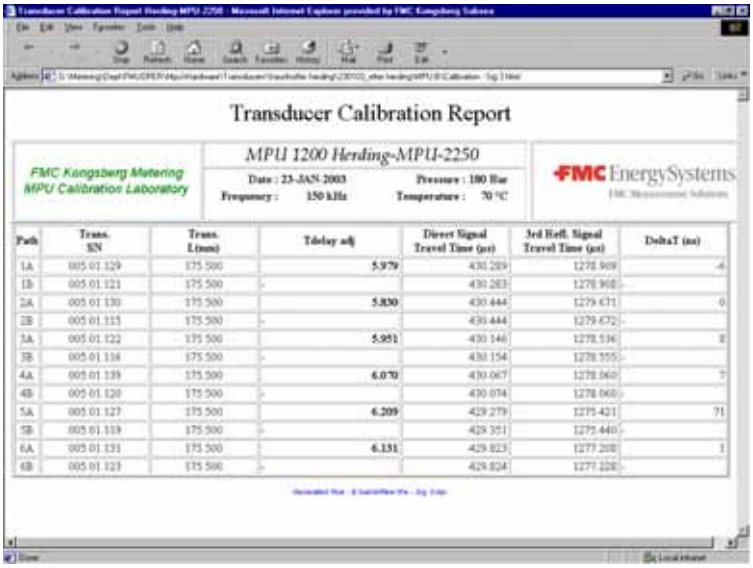
The header shows:

- Date
- Pressure
- Temperature
- Signal frequency

The table shows:

- Path 1 to 6, referring to position 1A/1B to 6A/6B
- Transducer serial number (S/N), which is stamped on the transducer
- Transducer length (L), listed in millimeters (mm)
- Tdelay adj, referring to Transducer delays in microseconds (µs) to be inserted into the database

The rest of the table is for information and diagnostic purposes only.



Picture 25 Transducer Calibration Report

5.3. Transducer delays

The transducers are calibrated in pairs. The transducer delays and delta T for spare transducer pairs are found in the supplied calibration certificates, one certificate for each calibration node. These must be entered for the respective Calibration Nodes. Make sure that the calibration data is inserted for the correct pressure and temperature combination. The data can be entered using the MPU WinScreen program. Instructions can be found in USM-0000020565, “WinScreen User Manual, MPU Series B” [1].

The database object number for the respective Calibration Nodes are shown in the table below.

	Database Object Number					
Description	**Node 1**	**Node 2**	**Node 3**	**Node 4**	**Node 5**	**Node 6**
Cal. Node x Pressure	500	509	518	527	536	545
Cal. Node x Temperature	501	510	519	528	537	546
Cal. Node x Signal Type	502	511	520	529	538	547
Cal. Node x Tr. Delay 1	503	512	521	530	539	548
Cal. Node x Tr. Delay 2	504	513	522	531	540	549
Cal. Node x Tr. Delay 3	505	514	523	532	541	550
Cal. Node x Tr. Delay 4	506	515	524	533	542	551
Cal. Node x Tr. Delay 5	507	516	525	534	543	552
Cal. Node x Tr. Delay 6	508	517	526	535	544	553

Table 4 Database object numbers for zero calibration nodes

5.4. Update path lengths

Due to minor variations of the length of the transducers, new data for the acoustic path length has to be entered when transducers are changed. The measured transducer lengths for the original transducers are stated in the Calibration Report for the meter. The measured transducer lengths for the new transducers are stated in the supplied measurement certificate. The acoustic path length is given by:

$$\mathbf{PathL_{new}} = \mathbf{PathL_{original}} + (\mathbf{L_{Original\ transd\ A}} - \mathbf{L_{New\ transd\ A}}) + (\mathbf{L_{Original\ transd\ B}} - \mathbf{L_{New\ transd\ B}})$$

$PathL_{new}$	= New acoustic path length
$PathL_{original}$	= Original acoustic path length
$L_{Original\ transd\ A}$	= Length of original transducer position A
$L_{Original\ transd\ B}$	= Length of original transducer position B
$L_{New\ transd\ A}$	= Length of new transducer position A
$L_{New\ transd\ B}$	= Length of new transducer position B

The new acoustic path length $PathL_{new}$ must be calculated according to the above formula and then entered into the database. The corresponding database numbers are shown in the table below:

Description	Database Object Number
Transducer Pair 1 Length	401
Transducer Pair 2 Length	402
Transducer Pair 3 Length	403
Transducer Pair 4 Length	404
Transducer Pair 5 Length	405
Transducer Pair 6 Length	406

Table 5 Database object numbers for path lengths

5.5. Documentation

It is important that relevant documentation is updated if transducers are replaced. A new printout of the database should be performed, or at least the recently entered data must be noted in the log book.

5.6. Example

Imagine the following situation:

1. A fault is detected at transducer number 5A.
2. Spare transducers are calibrated at pair 1.
3. The system has 3 nodes.

What to do:

1. Replace transducer 5A with spare transducer 1A (position Group A).
2. Replace transducer 5B with spare transducer 1B (position Group B).
3. Check the pressure and temperature combination for the 3 nodes by reading the database (see Table 4).
4. Then locate the 3 correct calibration certificates according to the right combination of pressure, temperature and frequency.
5. Enter the new transducer delay for the 3 nodes into the database, data for spare transducer 1A at position 5A and data for spare transducer 1B at position 5B.
6. Calculate new path length according to the formula in section 4.4.
7. Enter the new calculated path length for path 5A-5B into the database (see Table 5)
8. Update documentation.

The specifications contained herein are subject to change without notice and any user of said specifications should verify from the manufacturer that the specifications are currently in effect. Otherwise, the manufacturer assumes no responsibility for the use of specifications which may have been changed and are no longer in effect.

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